

TIME OF DAY MODELING PROCEDURES FOR IMPLEMENTATION IN FSUTMS

PROBLEM STATEMENT

Travel demand models in the State of Florida generally model daily travel demand and produce estimates of daily link volumes that are then converted to peak hour volumes through the application of appropriate conversion factors. Current FSUTMS models in the state operate on a daily basis and then produce peak hour estimates through a simple post-processing routine.

In recent years, there have been considerable advances in the modeling of travel demand and link volumes by time of day. These advances have been motivated by the need to address planning issues and answer questions that are time-of-day related. Time of day modeling procedures integrated into the four-step travel demand modeling process offer a more accurate and robust mechanism for obtaining time-of-day based estimates of travel demand and link volumes. These procedures account for differences across trip purposes, modes, and origin-destination pairs. Some of the issues that motivate the modeling of travel demand by time of day include, but are not limited to the following:

- Design hour traffic volumes for roadway design and level of service analysis
- Transit analysis
- Vehicular emissions and air quality analysis
- Assessing impact of congestion management programs
- Evaluating travel demand management strategies
- Evaluating variable (time-of-day based) pricing policies
- Analysis of peak spreading (time of day of travel choices)
- Analysis of intelligent transportation systems

In recognition of the importance of and the advances made in the modeling of travel demand by time of day, the USDOT's Travel Model Improvement Program (TMIP) embarked on the development of a new generation of modeling systems, called TRANSIMS, that is capable of accurately simulating travel patterns along the continuous time axis. In step with the directions provided by TMIP, this research project aimed to develop time of day modeling procedures that can be integrated into FSUTMS for immediate application in modeling practice in Florida. The time of day modeling procedures developed in this project would serve as a first step in the transition towards continuous time of day models such as TRANSIMS.

OBJECTIVES

The objectives of the research project were to do the following:

- Review state-of-the-art and state-of-the-practice time of day modeling procedures and identify those procedures most suitable for implementation in FSUTMS.
- Analyze time of day distributions of travel demand using Florida household travel survey data by trip purpose and mode of travel.
- Estimate time of day factors that can be used to obtain trip tables by purpose and time of day.

- Estimate time of day choice models that can be used to develop customized time of day factors for individual areas and origin-destination pairs.
- Examine the potential influence of level of service variables on time of day choice behavior to explore the possible presence of peak spreading.
- Provide guidance on the implementation of time of day modeling procedures in FSUTMS.

FINDINGS AND CONCLUSIONS

The research project has provided several key deliverables that would be of immense use to state and local agencies as they attempt to implement time of day modeling procedures capable of addressing planning issues that require information by time of day. Some of the major highlights of the research findings are as follows:

- The state-of-the-art in time of day modeling procedures has made great strides in the past decade. Many local and state agencies have attempted to develop time of day modeling procedures that are integrated within the four-step modeling process. There are several different methods for modeling travel demand by time of day within the four-step process including post-assignment, post-mode choice, post-trip distribution, and post-trip generation. All of these procedures have their own advantages and disadvantages, and one must examine the application context or planning issue being addressed before making a decision regarding the method to be adopted. In the context of this research project where a default procedure for implementation within FSUTMS was of interest, the post-trip distribution method was recommended. This method involves factoring trip tables by purpose by time of day prior to the mode split step in order to facilitate the consistent application of transit modeling procedures within the overall four-step process.
- The research project has resulted in the development of a CD containing several household travel survey databases drawn from Florida. These household travel survey databases are cleaned, processed, and thoroughly documented so that any area can analyze travel demand patterns by time of day and draw information that might be applicable to their particular context. In addition to these survey databases, the CD contains time of day distributions of trips by purpose and mode; all of the distributions show reasonable trends and allow one to isolate the peak and off-peak periods for different trip purposes. All databases provide information for weekday travel only.
- Based on the distributions of travel by time of day, this project resulted in the development of default time of day factors that can be applied in FSUTMS. The following table shows some sample time of day modeling factors drawn from the Tampa Bay area. These factors, when applied to daily trip tables, provide estimates of trips by time of day. The final report and CD provide time of day factors for different areas and different purposes, and thus serve as a resource for any area in the state.

Production-Attraction	AM Peak	PM Peak	Off Peak
HBW	67.44	6.22	26.34
HBSH	10.10	28.11	61.79
Attraction-Production			
HBW	3.36	66.82	29.82
HBSH	2.89	37.84	59.27

HBW = Home-based work; HBSH = Home-based shopping

- This project resulted in the development of time of day choice models of travel demand. Multinomial logit models of time of day choice were estimated using household travel survey data from the Tampa Bay area and the Southeast Florida area. Time of day choice models showed that time of day choice is influenced by socio-economic characteristics of the household and person. These models can be used to estimate customized time of day factors applicable to a certain area by trip purpose and origin-destination pair.
- When level of service (LOS) variables were introduced into the time of day choice models as explanatory variables, they were not found to be very significant. Thus, the models did not appear to support the presence of peak spreading, at least in the Southeast Florida Regional Travel Survey database. However, there are several considerations with respect to this finding. First, the LOS variables are input from the FSUTMS skim files based on the geocoded origin and destination location information in the travel survey database. These skims are zone-to-zone LOS variables and are thus more aggregate than the point-to-point origin and destination information available in the data set. Further analysis of the appropriateness of using zonal-level skims to model individual-level time of day choice behavior must be conducted before a definite conclusion can be drawn regarding the presence or absence of peak spreading.

BENEFITS

This research project has resulted in the development of a detailed set of time of day modeling procedures for implementation in FSUTMS. The developed time of day factors and time of day choice models can be implemented immediately within the FSUTMS framework. The travel demand models are used to make multibillion dollar investment decisions and to formulate transportation policy with respect to pricing schemes and congestion mitigation. The developed methods will greatly benefit the state as agencies will be able to accurately and reliably estimate travel demand by time of day and identify appropriate transportation solutions in different application contexts. The time of day modeling procedures directly benefit intermodal and multimodal planning in the state as the analysis and provision of transit services is directly related to estimates of travel demand by time of day. Consequently, transit agencies will be able to better plan and optimize their services in response to traveler demand.

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